**BUREAU OF ENVIRONMENTAL REMEDIATION POLICY**

# MONITORED NATURAL ATTENUATION

**BER POLICY # BER-RS-042**
**DATE:** March 30, 2001
**TOTAL PAGES: 5**

The Kansas Department of Health and Environment - Bureau of Environmental Remediation (KDHE-BER) is committed to evaluating and considering proposals for Monitored Natural Attenuation (MNA) of certain contaminants at suitable contaminated sites across Kansas. KDHE-BER remains fully committed to the goal of protecting human health and the environment by reducing the volume, toxicity of contaminants, hazardous substances, or pollutants through treatment, restoring contaminated ground water to its most beneficial uses, preventing the uncontrolled migration of contaminated ground water, preventing the degradation of surface water quality by contaminated ground water, and protecting all other environmental resources in Kansas. MNA is a remedial alternative that may be evaluated and compared with other applicable remedies at a contaminated site. MNA is not a default remedy; KDHE-BER considers MNA to be an alternative means of achieving remediation goals in certain circumstances where all applicable statutory and regulatory requirements are met by MNA and where conditions are conducive to MNA. KDHE-BER does not allow the further degradation of a contaminated media through MNA. United States Environmental Protection Agency (USEPA) OSWER Directive 9200.4-17P serves as the basis for KDHE-BER=s MNA policy and should be referenced. This policy provides further clarification of additional KDHE-BER requirements to the guidance provided by EPA Directive 9200.4-17P.

The term MNA as used in the EPA Directive and the KDHE-BER policy refers to the reliance on natural attenuation processes (within the context of a carefully controlled and monitored site cleanup approach) to achieve site-specific remediation objectives within a time frame that is reasonable compared to those time frames offered by other more active methods. The Anatural attenuation processes@ that are at work in such a remediation approach include a variety of physical, chemical, or biological processes that, under favorable conditions, act without human intervention to reduce the mass, toxicity, mobility, volume, or concentration of contaminants in soil or groundwater. These in-situ processes include biodegradation; dispersion; dilution; sorption; volatilization; radioactive decay; and chemical or biological stabilization, transformation, or destruction of contaminants.

All approvals for MNA shall be made on a site-specific basis, in accordance with this policy and by the KDHE project manager, program manager, and Section Chief. The Bureau Director may also be consulted during final determination. Ultimately, the Secretary of KDHE has the authority to require cleanup and determine the manner of that cleanup at contaminated sites in Kansas.

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**Criteria for Determining When MNA May Be Appropriate:** A proposal for MNA must be submitted to KDHE-BER and must evaluate in writing each of the following:

1) Threat to Human Health - The proposal shall document that MNA will not pose an unacceptable risk to human health. All potential current and future targets/exposure receptors must be identified and may not be impacted or threatened. MNA will not be approved in situations where public or private drinking water wells have been impacted or are threatened to be impacted above human health-based goals as defined by the Risk-based Standards for Kansas (RSK) Manual. MNA of soil will not be approved when soil contaminant concentrations exceed the human health-based goals, as defined by the RSK Manual and amendments thereto, and when access to a site is unrestricted.

2) Degradation of Ground Water - The proposal shall document that MNA will not allow continued degradation of ground water quality. The MNA proposal must demonstrate the ground water contaminant plume is stable or shrinking and that no additional migration of contamination is occurring. MNA of soils is not appropriate where downward leaching of the contaminants in the soil column may contaminate ground water to levels above the ground water goals for the site. KDHE has calculated soil concentrations that are generally protective of ground water; these soil concentrations are included in the RSK Manual.

3) Degradation of Surface Water - The proposal shall evaluate the potential for degradation of surface water quality via surface runoff or ground water discharge to surface water. MNA is not an acceptable remedial approach for sites where contamination is already impacting or threatening surface water quality.

4) Threat to Other Potential Receptors - The proposal shall determine if there will be an impact to wildlife, vegetation, domestic animals, or farm stock. Additional evaluation should be made of potential migration to off-site locations through underground trenches, tile lines, storm water and other drainage systems.

5) Time Frame and Cost - The proposal shall provide documentation that MNA will achieve the site cleanup goals, as determined by KDHE-BER, within a reasonable time frame and in a cost- effective manner when compared to other viable corrective action alternatives for the site. The costs of implementing MNA, including long-term monitoring, financial assurance and a contingency plan shall be fully evaluated

and compared with the costs of active remediation strategies which meet the site cleanup goals in a shorter time frame.

6) Property Control - The proposal must document that the responsible party owns all impacted property or is otherwise able to exert legal control over uses of such property. Plumes that impact other parties' properties shall not be considered for MNA unless permission is granted in writing by each off-site property owner or the potentially responsible party/voluntary party has legal control over the use or zoning of the impacted/threatened properties.

**Site Characterization To Determine If Site Is Suitable For MNA:** The suitability of a site for MNA must be demonstrated on the basis of site-specific physical and chemical properties. Decisions to employ MNA as a remedy or remedy component should be documented thoroughly with site-specific characterization data. KDHE-BER may not require all the information outlined below for every site, especially when contaminant levels are only slightly in excess of the site-specific cleanup goals determined by the KDHE-BER or for contaminants that are documented to readily degrade in the site-specific hydrogeological setting. Site characterization requirements are:

1) Historical ground water and soil chemistry data that clearly demonstrate a decreasing trend of contaminant mass and/or concentration over time at appropriate monitoring or sampling points must be provided. The site data must demonstrate that further degradation of the aquifer is not occuring. The plume must be demonstrated to be stable or diminishing in vertical and lateral extent. A set of four consecutive quarterly sampling episodes from the same monitoring wells is required at a minimum to begin to make such evaluation.

2) Hydrogeologic and geochemical data must be collected to demonstrate the MNA processes active at the site and the rate at which such processes are reducing contaminant concentrations. Specific parameters including, but not limited to the following, should be evaluated to demonstrate the efficacy of MNA:

a) dissolved oxygen
b) soil pH
c) redox potential

d) temperature
e) alkalinity
f) sulfate
g) sulfide
h) methane
i) ethane/ethene
j) total organic carbon
k) chloride
l) iron
m) nitrogen
n) nitrate
o) nitrite
p) the contaminant of concern and daughter products of contaminant decay
q) any others, as appropriate for site-specific conditions and contaminants
18) carbon dioxide
19) manganese
20) hydrogen
21) conductivity

3) Data from microcosm studies.

**Monitoring Requirements:** A monitoring plan is required for any MNA site. The monitoring plan shall include monitoring procedures which will confirm that: 1) degradation mechanisms remain active; 2) contaminant mass, volume and area are decreasing over time; and 3) contaminant decreases are due to attenuation and not migration of contaminants. At a minimum, the contaminant concentrations shall be monitored at a frequency approved by the department and based on documented site-specific information to establish that concentrations are decreasing over time. Monitoring will be required until contaminant levels reach site cleanup goals and KDHE-BER approved post-cleanup verification sampling is completed.

**Other Requirements:**

1) A Source Control Plan must be developed, approved by KDHE-BER, and implemented by the voluntary or potentially responsible party to address active source areas or hot spots before or while MNA is being implemented. Hot spots include areas where high concentrations of contaminants are present in soil and/or ground water.

2) A contingency plan must be developed and approved by KDHE-BER for remediation/control of the uncontrolled portion of the contaminated plume in the event that MNA proves ineffective. The contingency plan should identify monitoring triggers that would require initiation of the contingency plan. For example, the contingency plan would be implemented if it is determined that the plume is continuing to migrate and/or impact or threaten potential receptors and/or violate KDHE=s position on degradation of ground water and surface water.

3) Institutional controls must be placed on all impacted property with MNA approved as the remedy. Institutional controls must restrict future use and inform all future landowners of the nature of environmental conditions present at the property until such time as KDHE-BER determines that site-specific cleanup goals have been achieved.

4) The KDHE-BER may determine that a financial assurance bond is required for the MNA action to assure that the contingency plan can be implemented in case the voluntary or potentially responsible party be no longer viable.

In summary, KDHE-BER=s decision to implement MNA at a contaminated site will be based on appropriate site characterization, KDHE-BER approved site-specific cleanup goals, legal control of the impacted property/ies and the performance of measures to control all sources and/or hot spots. Additionally, the progress of MNA towards site cleanup goals must be carefully monitored and compared with expectations to ensure that it will meet those cleanup goals within a time frame that is reasonable compared to time frames associated with other potential site remedies. Contingencies and financial assurances will be required by KDHE-BER at some sites to assure that MNA meets the agency=s expectations. Approval of MNA as a remedial approach does not waive KDHE=s right to seek any Natural Resource Damages.